Electronic Services - Los Angeles
M12023X

WARNING

Because of possible shock or fire hazards, connection to this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

1 January 1980

Revision A

OPERATOR'S MANUAL

TM-103062

MODEL K103 TEST KIT

AND

MODEL 604A DISTURBANCE SIMULATOR

GENERAL ELECTRIC
INSTRUMENTATION & COMMUNICATION
1200 KONA DRIVE
COMPTON, CA 90220
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NOTE

Refer to Volume 2 (Service Manual) of TM-102700 for supplemental information.

This equipment is manufactured under U.S. Patent Number 3,549,874 - Dranetz Eng. Labs., Inc. 23207

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SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

This manual is a supplement to TM-102700 (Operator's Manual and Service Manual for the Series 606 Power Line Disturbance Analyzer). Together, these manuals provide complete operating and maintenance instructions for the Model K103 Test Kit and the Model 604A Disturbance Simulator (hereinafter referred to as the Simulator), manufactured by Dranetz Engineering Laboratories, Incorporated, South Plainfield, New Jersey. This section describes the purpose, application, and technical characteristics of the Test Kit and the Simulator.

1-2. PURPOSE

The Simulator is a compact, portable, calibrated disturbance simulator that operates from the single-phase power line (115/230V, 50/60Hz. nominal), and produces three 2-wire outputs that simulate sags, surges, impulses, and slow variations in AC voltage. It is used to implement rapid performance verification of any Model 606 in the field or on the test bench.

The Model K103 Test Kit (which includes the Simulator) comprises all the equipment normally required (except for general purpose meters and an oscilloscope) for comprehensive checkout, as well as troubleshooting, repair, and recalibration, of any Model 606 Power Line Disturbance Analyzer.

1-3. EQUIPMENT CHARACTERISTICS

The following items of equipment are included in the Model K103 Test Kit:

a. Model 604A Line Disturbance Simulator (described in paragraph 1-2.)

b. Test and Calibration ROM (Ident No. 026U26, P/N 105026). This ROM permits the user to select the Analyzer measurement functions and detectors individually. It is to be used with any Model 606 containing a CPU A3 Board identified as P/N 103120-G2 or 102720. (See Table 1-1.) Refer to Section V of TM-102700 for a detailed description of the purpose and operation of this ROM.

c. Test and Calibration ROM (Ident No. 036U26, P/N 105036). This ROM permits the user to select the Analyzer measurement functions and detectors individually. It is to be used with any Model 606 containing an A3 Board identified as P/N 103120-G1 or 106630-G1. (See Table 1-1.) Refer to Section V of TM-102700 for a detailed description of the purpose and operation of this ROM.

Table 1-1. ROM Selection Guide

A3 Board (CPU)	RAM Test ROM		Test and Calibration ROM	
	Ident No.	D.E.L. Part No.	Ident No.	D.E.L. Part No.
P/N 102720	028, U26	105028	026, U26	105026
P/N 103120-G2	028, U26	105028	026, U26	105026
P/N 103120-G1	035, U26	105035	036, U26	105036
P/N 106630-G1	035, U26	105035	036, U26	105036

A3 Board (CPU)	Printer Test ROM	
	Ident No.	D.E.L. Part No.
P/N 102720	027, U26	105027 A B or C
P/N 103120-G2	027, U26	105027 A B or C
P/N 103120-G1	027, U26	105027 A B or C
P/N 106630-G1	027, U26	105027 A B or C

A5 Printer Type	ROM Type
A5 P/N 102730	027A or B, U26 105027A, B or C
A5 P/N 103600	027C, U26 105027C

d. Printer Test ROM (Ident No. 027U26, P/N 105027). This ROM is used to localize the cause of Analyzer malfunctions to either a faulty CPU Board A3 or to a faulty printer. Since CPU Board A3 is the major controlling element of the Analyzer, oscilloscope waveform analysis may also be required to enable this determination. Refer to Section V of TM-102700 for a detailed description of the purpose and operation of this ROM.

e. Version 027C of the Printer Test ROM eliminates the "Busy Signal Too Short" test which allows the printing of the normal test message with the DEL P/N 103600 Printer Assembly.

When testing a unit which uses the DEL P/N 102730 Printer (A5) Assembly, the Busy signal must be verified by measurement in accordance with TM-102700.

f. RAM Test ROM (Ident No. 028U26, P/N 105028). This ROM tests the Random Access Memory (RAM) of CPU Board A3 and prints out the status with identification of each RAM circuit chip. Provision is included for

repetitive testing with an audio alarm activated when a defective chip is located. This ROM is to be used with any Model 606 containing an A3 board identified as P/N 103120-G2 or 102720. Refer to Section V of TM-102700 for a detailed description of the purpose and operation of this ROM.

g. RAM Test ROM (Ident No. 035U26, P/N 105035). This ROM tests the Random Access Memory (RAM) of CPU Board A3 and prints out the status with identification of each RAM circuit chip. Provision is included for repetitive testing with an audio alarm activated when a defective chip is located. This ROM is to be used with any Model 606 containing an A3 board identified as P/N 103120-G1 or 106630-G1. Refer to Section V of TM-102700 for a detailed description of the purpose and operation of this ROM.

h. A3 (CPU) Board P/N 106630-G1 uses different RAM IC chips from P/N 103120. To maintain compatability, RAM identification U20 thru U23 refers to U20, data bits 0 thru 3. U19 identification is not affected.

i. Card Puller (P/N 103064). The card puller simplifies removal of major plug-in cards.

j. Extender Card (P/N 102677). This card permits major plug-in cards to be operated outside of the card rack, facilitating calibration and troubleshooting.

k. Extender Cable Set (P/N 103060 and P/N 103061). The Cable Set permits extended card operation of Analyzers equipped with Option 101.

Revision Data

Revision to TM-103062, Operator's Manual Model K103 Test Kit

In paragraph 1-3:

1) Printer Test ROM P/N 105027 has been revised to Rev. C. This change eliminates the "Printer Busy Too Short" test to facilitate testing Dranetz Printer P/N 103600.

2) Test ROMs P/N 105026 and 105028 are no longer supplied with K103 kits since their use is limited to very early production 606's. If required, these parts are available for separate purchase through Customer Service.

3) For A3 board, P/N 107416, diagnostic ROM P/N 105079 is supplied in the K103 kit. This ROM contains software for printer test, RAM test and CPU tests.

1-4. ADDENDUM 1

This Addendum applies to all Series 606 and 616 Analyzers equipped with new CPU (A3) board P/N 107416. This new board adds the following features to the 606's and 616's:

1. Option 106 (RS232 Capability)
2. Channel A directivity for 616's (Option 105)
3. New DC voltage range for 616's (Model 616C).
4. A revised test/calibrate capability

1-5. CPU BOARD P/N 107416

The new CPU board is directly compatible with existing 606/616 mainframes. The master ROM on the CPU board now includes resident options that are enabled under software control as a function of the state of various jumpers and switches on this board.

Configuring the A3 Board

The jumpers and switches used to configure the A3 board appear on the assembly drawing of figure 1. Table 1 identifies the functions of these components.

Table 1. Functions of Jumpers and Switches

Item	Function
J3	Selects PROM/ROM for socket U23
J4	Selects PROM/ROM for socket U24
U23, U24	Memory sockets
J2	U23 and U24 address assignment jumpers
J5	Master ROM based, option enable jumpers
S1A	Selects 1Ø (for 606-1) or 3Ø (for 606-3)
S1B	Enables calibrate function

NOTE: Jumper J5 and switches S1A and S1B simply enable software. To enable an option, the appropriate optional hardware must be present in the system.

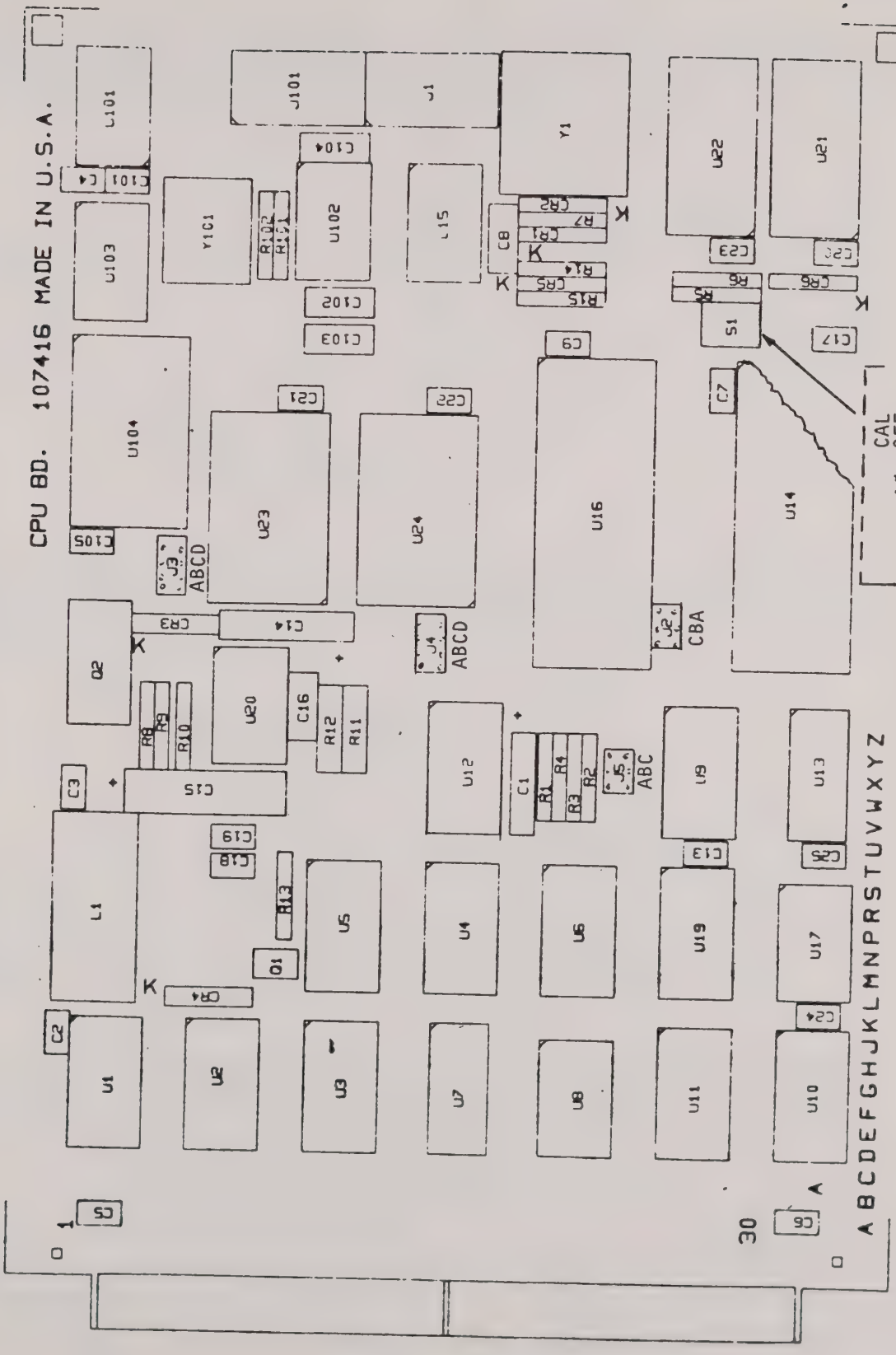


Figure 1. CPU Board, Assembly Drawing

Proper jumpering of J3 and J4 permits U23 or U24 to accept one of three different PROM/ROM types, in conjunction with appropriate address assignments at J2. Table 2 summarizes the PROMs selected by jumpers J3 and J4.

Table 2. PROM Selection Summary, J3 and J4

PROM type	Jumper Position			
	A	B	C	D
2716 (Intel)	S	O	O	S
2732 (Intel)	O	S	O	S
2532 (T.I.)	S	O	S	O

where: J3 applies to U23
J4 applies to U24
S = Short or jumpered
O = Open or unjumpered

J2 contains the U23 and U24 address assignment jumpers. All 1-PROM 606/616's should be jumpered at J2-C. J2-B is the Options Enable position. All 606/616's requiring a ROM at U23 and U24 should be jumpered at J2-B. J2-A is not used. Table 3 summarizes the J2 jumpers.

NOTE: J2 must not be jumpered in more than one position simultaneously.

Table 3. J2 Jumper Codes

	Jumper Position		
	A	B	C
Standard 4K	O	O	S
Option Select	O	S	O
Not Used	S	O	O

Jumper bar J5 and switch S1 are used to enable the options resident in the standard master ROM at U24. Tables 4 and 5 show the options enabled by J5 and S1, respectively.

Table 4. Standard Options Enabled by J5

Option Enabled	Jumper Position	Equipment Required
RS232 (Option 106)	J5-A	RS232 Interface Hardware
Buffered RS232	J5-B*	Buffered RS232 terminals
Frequency Option 101	J5-C	Appropriate frequency counters

*This position is never jumpered alone. If used, J5-A must also be jumpered.

Table 5. Options Enabled by S1

Switch	Position	Option Enabled	Notes
S1A	OFF	606-1 Single Phase Unit	N/A for 616's
S1A	ON	606-3 3-Phase Unit	Always on for 616's. Requires necessary detectors for phases B and C for 606's
S1B	OFF	Operate mode	Normal position when not in calibrate mode.
S1B	ON	Calibrate mode	P/O K103 field service capability. Works for all 606/616's with any option. Refer to Section 5 of Service Manuals.

1-6. TEST/CALIBRATE FUNCTION

The calibrate function of the new A3 board is virtually identical to the function provided by the Test and Calibration ROM provided for previous 606's and 616's. (Refer to Section V of the corresponding service manuals: TM-102700 and TM-103140, respectively). However, the calibrate function is now resident in the master ROM on the new A3 board. This resident capability, along with the new K103 Test ROM (P/N 105079), constitutes the complete software package for the K103 Field Service Test Kit.

Enabling the 606/616 Calibrate Software

a. Turn off the instrument and remove the A3 board, being careful not to damage the ribbon cable if the unit is equipped with Option 101.

b. Referring to figure 1, set dip switch S1B to the ON (CALIBRATE) position.

c. Reinstall the A3 board. If one wishes to use an extender board, an extender cable will be required for Option 101 units.

d. The calibration function is now enabled. Turn on the instrument and follow the instructions given in Section V of the appropriate Service Manual.

Test and Calibration

As for previous 606/616 versions, the software allows the user to select a detector and print the voltage at that detector, using the standard fault message formats. The SLOW AVG threshold switch is used as the threshold select switch; the SAG/SURGE threshold switch is used as the phase or channel selector. Using these two switches, any detector can be selected and its contents printed.

In the case of the average and cycle detectors, the user can generate a continuous display by leaving the PRINT pushbutton turned on. A display can be generated on demand by depressing the PRINT pushbutton off and depressing the TEST pushbutton. For display of the frequency and impulse detectors, the PRINT pushbutton must be on and the user must have a means of generating valid faults (e.g., by using the 604A).

Table 5-3 in the 606/616 Service Manuals summarizes the selector positions and the associated displays in detail. Table 6 below summarizes the calibrate function. Note that references to sag, surge, average, impulse and frequency refer to the type of fault message used to display the detector values.

Table 6. Calibrate Detector Selection Summary*

Detector Selector Position	Phase Selector Position (SAG/SURGE Threshold Switch)			
	Phase A	Phase B	Phase C	Freq. Only
1	PHASE A CYCLE 1 SURGE	PHASE B CYCLE 1 SURGE	PHASE C CYCLE 1 SURGE	NA NA RESET
2	PHASE A AVERAGE AVG	PHASE B AVERAGE AVG	PHASE C AVERAGE AVG	NA NA RESET
3	PHASE A CYCLE 2 SAG	PHASE B CYCLE 2 SAG	PHASE C CYCLE 2 SAG	NA NA RESET
4	PHASE A IMPULSE IMPULSE	PHASE B IMPULSE IMPULSE	PHASE C IMPULSE IMPULSE	NA FREQ COUNTERS FREQ

*The first entry in each box refers to the phase, the second refers to the type of detector and the third refers to the type of fault message used for the printout. Sag/surge messages will generate 0 cycles. Attempts to access phases B and C on 606-1 units will result in reset messages. The selector position numbers are referenced from the fully counter clockwise position. Actual fault message formats will vary slightly for differently optioned units. Refer to Section V of the Service Manuals for details on specific adjustments required to bring the unit into calibration.

1-7. K103 TEST ROM (P/N 105079)

The test program resides on a 2K byte Intel 2716 type PROM. This software provides for four test functions which can be run either continuously or in a stepwise fashion by proper use of the PRINT and TEST pushbuttons. Each test function is selectable using the SLOW AVG threshold switch as a test select switch. The tests are summarized in Table 7. The single K103 Test PROM applies to all 606/616 units.

Table 7. K103 Test Summary

Test Selector Position	Test Selected	Notes
1	Printer Test	Activated on power up or on position 1.
2	Test all	Performs all tests (3,4,1 in that order) and also exercises the CPU. If the RAM test fails, tests 1 and 4 will be aborted.
3	RAM test	Exercises RAM chips U21 and U22 with a computer pattern. Test lasts approx. 4 seconds. If the test fails, the alarm rings and the defective chip(s) are printed out.
4	Print all ports	Reads the 12 (0-B hex) internal ports through which the CPU board communicates with the outside world and prints the contents in binary form.

Using the K103 Test ROM

Although the test ROM is designed to operate in either socket U23 or U24 on the A3 board, it is generally more convenient to run it in socket U23. It is then handled as if the test ROM is any other software option. To run the ROM in U23, observe the following constraints:

1) U24 must contain the 606/616 master ROM.

2) U23 must be jumpered at J3 to accept a 2716.

3) J2-B must be jumpered.

CPU (A3) boards with U23-based options simply require the removal of the option PROM and insertion of the test ROM. Non-option units normally simply require moving the J2 jumper from C to B and inserting the test ROM into U23. To run the test ROM in U24, observe the following constraints:

1) U24 must be jumpered at J4 to accept a 2716.

2) J2-C must be jumpered.

Before powering up the test program, the ALARM pushbutton should be on. The PRINT pushbutton may be either on or off, as desired. After turning on the unit, a 2-3 second delay will allow the hardware to settle and the alarm will sound to let the operator know that power up and minimum CPU board function has been achieved. At this point, the software prints out the printer test message. This verifies CPU and printer function immediately and unconditionally because proper operation of the other tests depend on the CPU and the printer.

At this point, the software enters the test control loop which determines which test has been selected and when to execute the test. All test functions eventually return to this loop. If the PRINT pushbutton is OFF, the program checks the on/off status of the TEST pushbutton. If the TEST pushbutton is on, the selected test function is executed; if off, the unit waits until either TEST or PRINT is depressed. Thus, the user can continuously execute a test by leaving the PRINT pushbutton on, or selectively execute tests by turning off the PRINT pushbutton, selecting a test, and depressing the TEST pushbutton.

K103 Printer Test

This test verifies printer operation by printing a fuel character set test sequence:

```
PQRSTUVWXYZ[\]↑←
@ABCDEFGHIJKLMNO
0123456789:;<=>?
 !"#$%&'()*+,-./
```

Upon power on, or when the printer test is completed as part of the "test all" sequence, the message

K103 TEST ROM

prefaces the printer test sequence. By inspection, the user can determine if a printer malfunction exists.

The printer test monitors the print "busy" line to insure that the software does not hang up in a "busy/wait" loop. If the busy signal remains high for more than 23 milliseconds, the software assumes the line is hung up and attempts to force the following diagnostic message:

PRINT BUSY TOO LONG

When the test/diagnostic message ends, the program returns to the test control loop. If the printer test fails, the fault must be remedied before testing can be resumed.

K103 RAM Test

The RAM resides at U21 and U22. The CPU tests RAM by repeatedly sending test patterns to these chips and verifying the results. If the RAM test succeeds, the unit prints RAM TEST PASSED and the program returns to the test control loop. If the RAM test fails, the unit sounds the alarm, determines which chip is faulty and prints one or both of the following:

RAM U21 FAILED

(and/or)

RAM U22 FAILED

The RAM test should be performed in the continuous mode because certain RAM failures/problems may not be detected in one test. Twenty tests should be performed to detect marginal problems.

Print All Ports Test

During this test, each internal CPU board port is read and its 4-bit binary contents is printed. This test should not be performed unless both the printer and RAM check out because it depends on both of these components to function properly. The test can be used to exercise the "port read" function and to verify the contents of certain ports.

The information is printed in the following format:

"PORT # 0X XXXX"

The port number ranges between 00 and 0B hex. The 4-digit binary number that follows the port number represents the state of each of the four input lines at each port. This test is included as an aid in testing and debugging the mainframe and is primarily intended for a skilled technician familiar with the operation of the unit.

Test All Function And CPU Test

The "test all" function performs each of the tests plus a CPU test. The CPU test software executes instructions and instruction types that haven't been used previously in the test software. Instructions previously exercised are implicitly assumed to be operating properly. The CPU test extensively exercises the CPU to build confidence in its operation. Successful execution produces a "CPU OKAY" message. If the CPU test fails, the unit reacts in one of the following ways:

1) It prints "CPU ERROR."

2) It ceases operation completely.

3) It resets itself and continues to operate but fails to print the "CPU OKAY" message.

The "test all" function executes the tests in the following order:

1) RAM test.

NOTE: If the RAM test fails, all other tests will be aborted and control returns to the test control loop.

2) Print all ports test

3) CPU test

4) Re-execution of the power up sequence and the printer test

5) Return to test control

SECTION II

OPERATION

2-1. GENERAL

This section contains the basic operating procedures for the Simulator. The functions of all operating controls are described in detail. For operating information on all other items contained within the Model K103 Test Kit, refer to Section V of TM-102700 (Service Manual for the Series 606 Power Line Disturbance Analyzer).

2-2. OPERATING CONTROLS

The functions of all top panel operating controls are presented in Table 2-1. All referenced items are shown in figure 2-1.

Table 2-1. Operating Controls

Index No.	Controls	Function
1	Nominal Input Switch	Slide switch position determines proper single phase input voltage (either 115 or 230V RMS).
2	PHASE Selector Switch	Three position switch determines which output phase is to be affected by disturbance controls.
3	ON/OFF Switch	ON Position: Applies power to Simulator. OFF Position: Power off.
4	NORM/IMP CAL Switch	NORM Position: AC voltage appears on three output phases. IMP CAL Position: Removes AC line voltage from the outputs to permit observation of impulse amplitude.
5	AVG Knob	Determines output voltage (percentage of input voltage) on selected phase.

Table 2-1. Operating Controls (Cont'd.)

Index No.	Controls	Function
6	SAG Knob and Pushbutton	Knob determines output voltage decrease (percentage of input voltage) which is applied to steady-state voltage on selected phase when pushbutton switch is depressed. Duration limited to a maximum of approximately 16 cycles.
7	SURGE Knob and Pushbutton	Knob determines output voltage increase (percentage of input voltage) which is applied to the steady-state voltage on selected phase when pushbutton switch is depressed. Duration limited to a maximum of approximately 16 cycles.
8	IMPULSE Knob and Pushbutton	Knob determines peak impulse voltage which is applied to the selected phase when pushbutton is depressed.

2-3. CONNECTION INSTRUCTIONS

For detailed connection instructions, refer to paragraph 3-4 of TM-102700.

2-4. OPERATION

Refer to Sections III and V of TM-102700 for operating instructions.

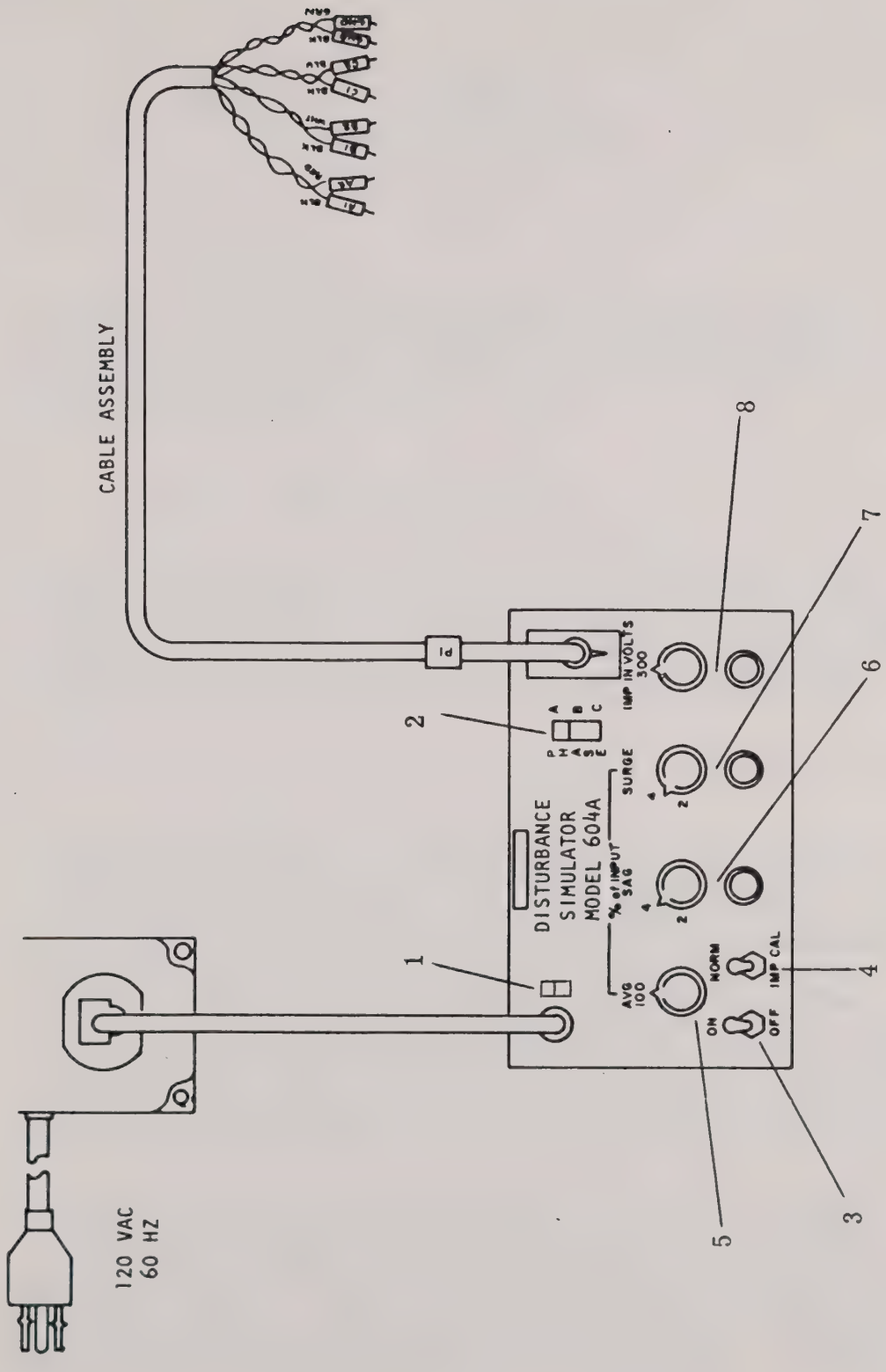


Figure 2-1. Model 604A Operating Controls

SECTION III

THEORY OF OPERATION

3-1. INTRODUCTION

This section provides a functional description of the Model 604A Simulator. The discussion is referenced to figures 3-1 and 6-1. Refer to Section V of TM-102700 for a functional description of the other items contained within the Model 103 Test Kit.

3-2. BASIC FUNCTIONAL DESCRIPTION

The Simulator simulates the four types of power line disturbances which the Series 606 is designed to measure and record. SLOW AVERAGE, SAG, and SURGE, variations in level at the power line frequency, are generated using an autotransformer technique. IMPULSES are generated by a capacitor discharge which is added to the power line voltage waveform using a step-up transformer.

3-3. DETAILED FUNCTIONAL DESCRIPTION

The Simulator output signal is derived from the power line by using T102 in an autotransformer configuration. The 40 VRMS secondary windings are connected in series. Potentiometer R4 is connected across both outputs. The output voltage of the Simulator is supplied through R103 from the center tap of the T102 secondaries. The secondaries are returned to the 115 VRMS primary through the wiper of R4. In this configuration, when R4 is set to its midpoint, the output voltage from the center tap is equal to the input voltage. By moving R4 clockwise to its stop, one-half of the total secondary voltage may be added to the input voltage, producing a higher output level. Moving R4 to its counter-clockwise stop causes one-half of the total secondary voltage to be subtracted from the input voltage, producing a lower output level.

For generation of line frequency surges (short term voltage increases), S2 is depressed, discharging capacitor C102 through the coil of relay K101. The charge stored in C102 is sufficient to hold K101 closed for approximately 250 ms or until S2 is released. When K101 is closed, it connects the output at point B to a higher voltage point on the T102 secondaries through R102. This causes a higher output level during the time that K101 remains closed. The amount of the increase is determined by the setting of potentiometer R2.

For generation of line frequency sags (short term voltage decreases), S3 is depressed, discharging capacitor C103 through the coil of relay K102. The charge stored in C103 is sufficient to hold K102 closed for approximately 250 ms or until S3 is released. When K102 is closed, it connects the output at point B to a lower voltage point on the T102 secondaries through R104. This causes a lower output level during the time that K102 remains closed. The amount of the decrease is determined by the setting of potentiometer R3.

Impulses are generated by depressing S1. This causes capacitor C105 to trigger SCR Q101. When triggered, the SCR discharges capacitor C107 through the primary of transformer T101. The resulting impulse is increased in voltage by T101 and is added in series with the normal line frequency output. Impulse amplitude is determined by the initial voltage on C107 which is determined by the setting of potentiometer R1 as well as variable resistors R110 and R122.

Two switching functions are provided for convenience of use. NORM/IMP CAL switch S4 allows generation of impulses without the power line frequency output. This allows scope triggering for impulse amplitude observation. PHASE selector switch S6 connects the active output of the Simulator to either Phase A, B, or C. A dummy 115 VRMS nominal output is connected to the other two output phases. This serves two functions. First, a signal is always applied to input Phase A of the Series 606 as required for proper timing (the Series 606 is synchronized to the frequency of the Phase A input signal). Secondly, disturbance printing by the Series 606 is minimized when switching the active signal between phases.

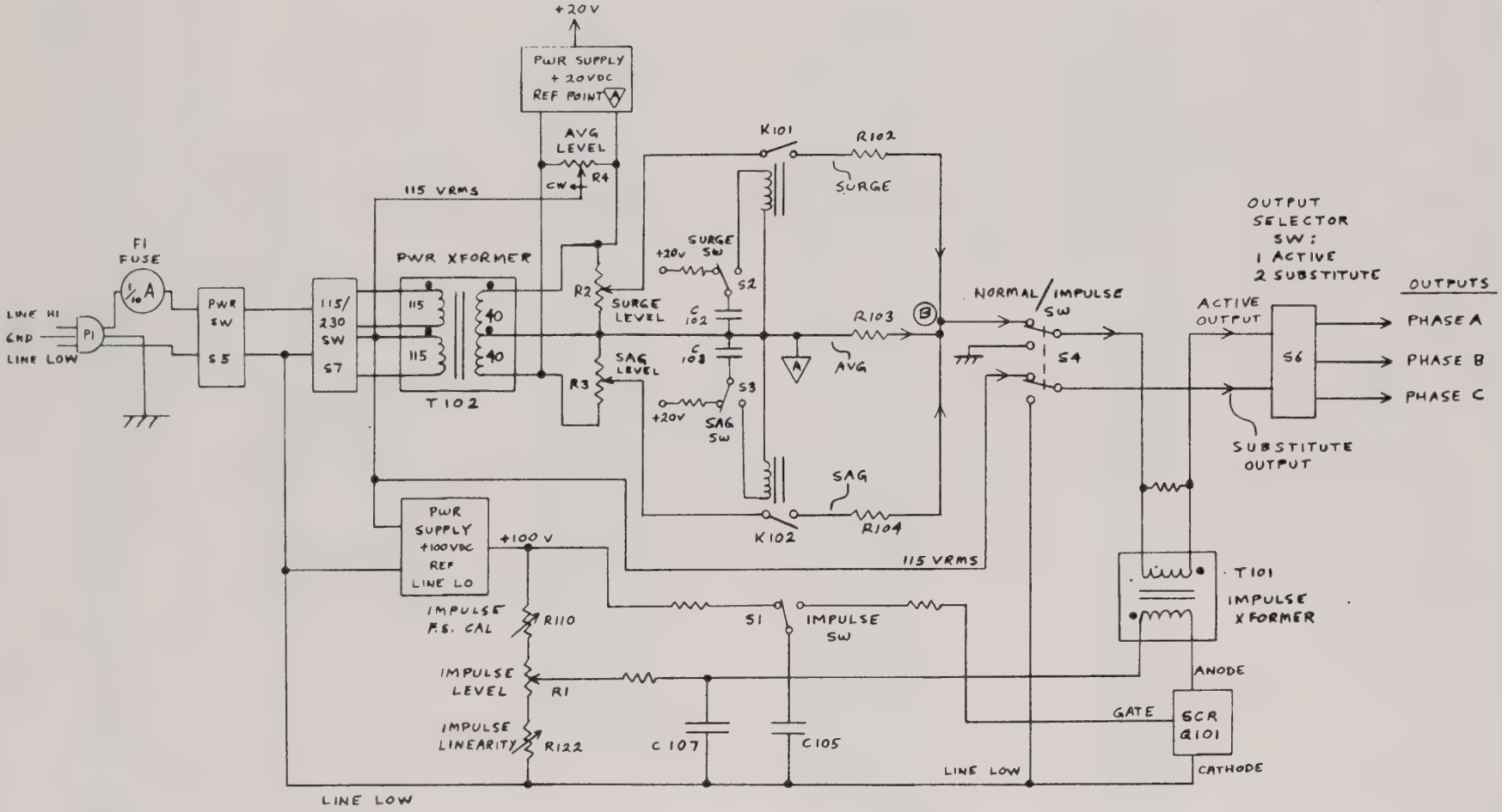


Figure 3-1. Model 604A Disturbance Simulator, Functional Block Diagram

SECTION IV

MAINTENANCE

4-1. SCOPE

This section contains procedures and data that will help ensure continuity of service of the Simulator. The remaining items of the Model K103 Test Kit are not serviceable in the field. They must be returned to the factory for repair. (See paragraph 4-4.)

4-2. RECOMMENDED MAINTENANCE

No routine maintenance is required for the Simulator. If the calibration is in doubt, the Simulator may be recalibrated using the adjustment procedure presented in paragraph 4-3. If adjustment fails to bring the Simulator within specification or if a severe failure is noted, repair should be performed using the information provided in Section III as well as the drawings in Section VI.

CAUTION

Never attempt to calibrate or repair the Simulator without using a line isolation transformer as shown in figure 4-1. Without the isolation transformer, grounded test equipment such as an oscilloscope could not be used. Even with an isolation transformer, hazardous voltage levels exist at most points in the Simulator circuitry.

4-3. ADJUSTMENT PROCEDURE (See fig. 4-1 for test circuit.)

WARNING

DANGEROUS VOLTAGES EXIST ON ALL CIRCUITS.

4-3.1. Average (AVG) Calibration

a. Remove AVG Knob. Set Nominal Input Switch to 115, PHASE Selector Switch to A, ON/OFF Switch to ON, and NORM/IMP CAL Switch to NORM.

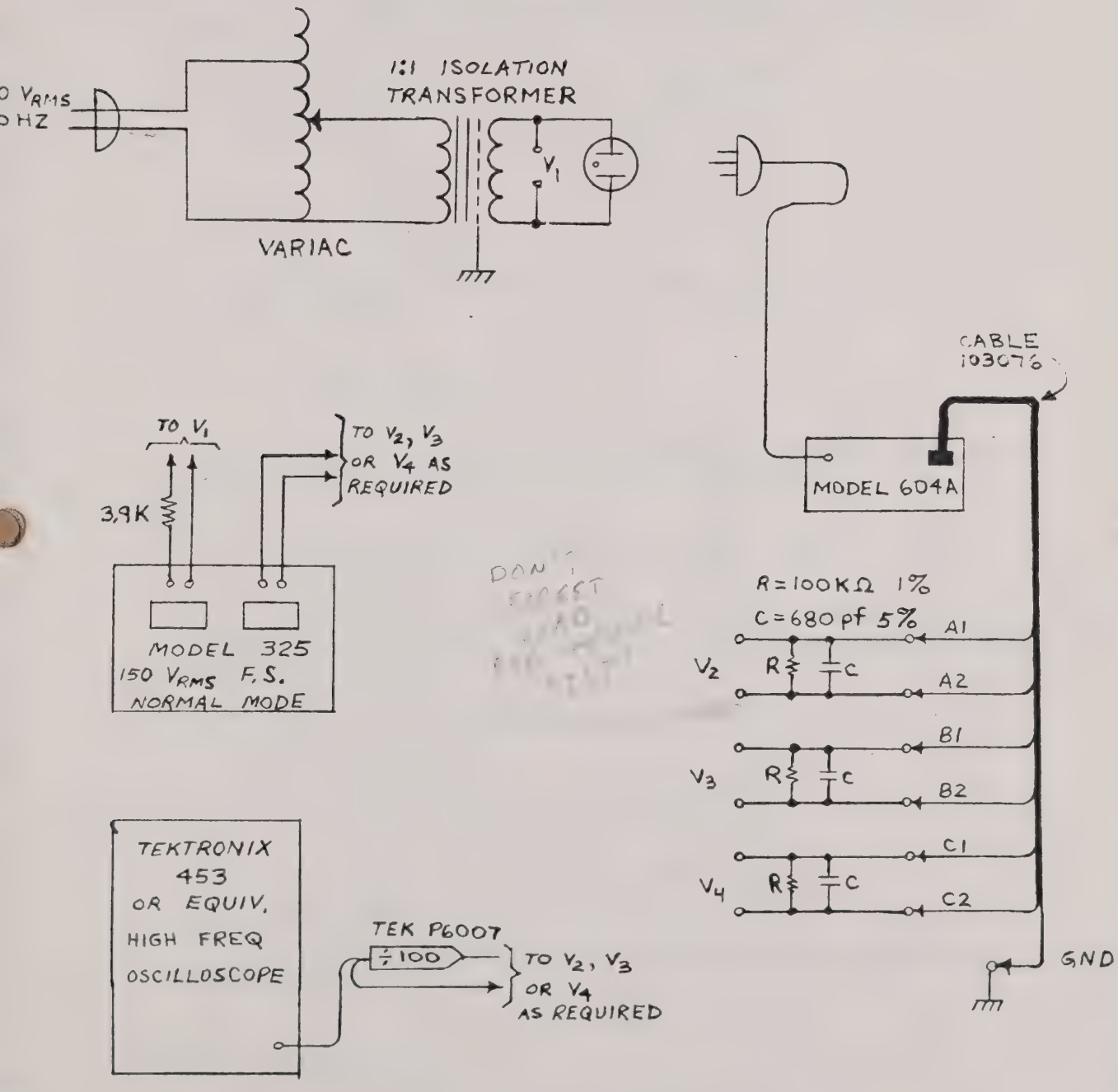


Figure 4-1. Model 604A Test Circuit

b. Adjust variac for $V_1 = 120 \pm 0.5$ VRMS. Adjust R4 for $V_2 = 120 \pm 0.2$ VRMS. Attach AVG knob (with one setscrew) in position indicating 100%. Check V_1 and V_2 for $V_2 = V_1 \pm 0.5$ VRMS with AVG knob set to 100%. If $V_2 = V_1 \pm 0.5$ VRMS, tighten second set screw.

c. With V_1 constant, check V_2 at the indicated settings of AVG knob:

AVG (%)	V_2 (VRMS)
90	106.5 to 109.5
100	119 to 121
110	130.5 to 133.5

Record results on figure 4-2.

d. If any readings are out of specification, correct AVG Knob attachment slightly.

4-3.2. SURGE Calibration

a. Remove SURGE knob. Set Nominal Input Switch to 115, PHASE Selector Switch to A, ON/OFF Switch to ON, and NORM/IMP CAL Switch to NORM.

b. Adjust variac for $V_1 = 120 \pm 1$ VRMS. Adjust AVG Knob for $V_2 = 120 \pm 0.3$ VRMS.

c. Connect TP1 to TP3 and adjust R2 for $V_2 = 132 \pm 0.5$ VRMS. Attach SURGE Knob in position indicating 10%. Check for $V_2 = 132 \pm 0.5$ VRMS. Tighten both set screws.

d. With V_1 constant, check V_2 at the indicated settings of the SURGE knob:

SURGE (%)	V_2 (VRMS)
2	121 to 124
10	131 to 133

Record results on figure 4-2.

e. If any readings are out of specification, correct SURGE knob attachment slightly.

4-3.3 SAG Calibration

a. Remove SAG knob. Set Nominal Input Switch to 115, PHASE Selector Switch to A, ON/OFF Switch to ON, and NORM/IMP CAL Switch to NORM.

b. Adjust variac for $V_1 = 120 \pm 1$ VRMS. Adjust AVG knob for $V_2 = 120 \pm 0.3$ VRMS.

c. Connect TP2 to TP4 and adjust R3 for $V_2 = 108 \pm 0.5$ VRMS. Attach SAG knob in position indicating 10%. Check for $V_2 = 108 \pm 0.5$ VRMS. Tighten both set screws.

d. With V_1 constant, check V_2 at the indicated settings of the SAG knob:

SAG (%)	V_2 (VRMS)
2	116 to 119
10	107 to 109

Record results on figure 4-2.

e. If any readings are out of specification, correct SAG knob attachment slightly.

4-3.4 Impulse (IMP) Calibration

a. Remove IMP knob. Turn R1 fully counter-clockwise and fasten IMP knob so that it points to reference mark.

b. Connect oscilloscope to A2 and GND using ÷100 probe. Probe compensation must have been recently set using oscilloscope square wave calibration signal. Disconnect the digital voltmeter during impulse calibration.

c. Set oscilloscope as follows:

Vertical: 1 V/division

Horizontal: 2 μsec/division

Trigger: INT., D.C., +, TRIG.

d. Set NOMINAL INPUT Switch to 115, PHASE Selector Switch to A, ON/OFF Switch to ON, and NORM/IMP CAL Switch to IMP CAL.

e. Set IMP knob to 500 Volts and depress IMP pushbutton to generate each impulse. Adjust R110 for a 500-volt impulse as measured by the oscilloscope. The impulse should rise (0 to V_{peak}) in approximately 2 μsec.

f. Set IMP knob to 100 Volts and depress IMP pushbutton to generate each impulse. Adjust R122 for a 100 Volt impulse as measured by the oscilloscope.

g. Repeat steps e. and f. until both 100 and 500 volt impulses are correct without further adjustment of R110 or R122.

h. Check impulse level at the indicated settings of the IMP knob:

IMP (V_{peak})	V_2 (V_{peak})
100	90 to 110
300	275 to 325
500	480 to 520

Record results on figure 4-2.

4-4. FACTORY REPAIR

When factory repair is desired, proceed as follows:

1. Contact the Dranetz Engineering Customer Service Department and obtain an Authorization Number.

2. Fill out the Repair/Service Order loosely enclosed in this manual and ship it with the equipment to the Customer Service Department. (A sample of the Equipment Repair Order is permanently bound in this manual. Leave this sample in place for reference.)

AVG

Set (%)	90	100	110
Read (v)	_____	_____	_____
Spec. (v)	106.5/109.5	119/121	130.5/133.5

SURGE

Set (%)		2	10
Read (v)		_____	_____
Spec. (v)		121/124	131/133

SAG

Set (%)		2	10
Read (v)		_____	_____
Spec. (v)		116/119	107/109

IMPULSE

Set (v)	100	300	500
Read (v)	_____	_____	_____
Spec. (v)	90/110	275/325	480/520

Figure 4-2. Model 604A Data Sheet

CUSTOMER SERVICE DEPT.
DRANETZ ENG. LABS., INC.
1000 New Durham Road
Edison, New Jersey 08818

REPAIR/SERVICE ORDER

TEL. (201) 287-3680
(201) 287-2535
TWX: (710) 997-9553
CABLE: DRANETZ

NOTE: THIS COMPLETED FORM MUST ACCOMPANY RETURNED EQUIPMENT

CUSTOMER SHIPPING & BILLING INFORMATION

CUSTOMER P. O. # _____ P. O. DATE _____

SHIP TO: _____ INVOICE TO: _____

In Continental U. S., material will be returned by Dranetz to you by UPS, UPS Blue or other carrier chosen by Dranetz unless otherwise designated.

EQUIPMENT BEING RETURNED

Date of Original Purchase: _____ Original P. O. # _____

Model No. _____ S/N _____

Model No. _____ S/N _____

Ancillary equipment also being returned (If you neglect this, these items may not be returned to you).

☐ Power & Other Cables _____ ☐ Instr. Book _____

☐ Plug-ins (incl. S/N) _____ ☐ Connectors _____

☐ Other _____

RETURN AUTHORIZATION

Have you discussed the problem with Dranetz Sales or Service personnel?

Dranetz Return Authorization # _____

By: _____

If so, with whom _____ Date: _____

Whom should the Dranetz Customer Service Dept. contact for technical questions?

_____ ( )

NAME (Print) DEPARTMENT TELEPHONE

DESCRIPTION OF PROBLEM

Please be detailed, explicit and complete. Include test data, if this helps to describe the problem.
IMPORTANT: Repairs cannot be made unless this section is completely filled out.
(Attach added sheets if necessary)

_____

_____

_____

_____

CHECK WHERE APPLICABLE: IS MALFUNCTION RELATED TO: Warmup ☐ Temperature ☐

Intermittency ☐ Mechanical Handling ☐ Visual Defects ☐ Grounding ☐ Test Data Attached ☐

INITIATOR OF THIS ORDER

_____

NAME/TITLE SIGNATURE TELEPHONE

(SEE OTHER SIDE FOR INSTRUCTIONS)

IMPORTANT (SEE OTHER SIDE FOR INSTRUCTIONS)

IMPORTANT (ENCLOSE THIS ENTIRE FORM WITH EQUIPMENT)

INSTRUCTIONS FOR REPAIR ORDER – DRANETZ ENGINEERING LABS.

IMPORTANT: FOLLOW INSTRUCTIONS & USE THIS FORM. IT IS DESIGNED TO HELP US HELP YOU.

1. Before returning equipment to our factory, call our Customer Service Department, Tel:(201) 287-2535 Give the model No., serial number, and information on the problem.

   A. Our specialists may be able to solve your problem rapidly without equipment return.

   B. If equipment return is needed, you will be supplied with appropriate instructions and authorization information to expedite service.

2. If return is to be made,

   A. Fill out the other side of this form COMPLETELY.

   B. Enclose original of form INSIDE the shipping carton, preferably attached by masking tape to the equipment.

   C. Ship prepaid (including insurance); we will return prepaid unless otherwise advised by you.

   D. IMPORTANT - PACK PROPERLY! SHIPPING DAMAGE WILL BE CHARGED TO YOU!

NOTE:

Statement of Warranty - All products of Dranetz Eng. Labs., Inc. are warranted to the original purchaser against defective material and workmanship for a period of one year from the date of delivery. Dranetz will repair or replace, at its option, all defective equipment returned, freight prepaid, during the warranty period, without charge for repair, provided there is no evidence that the equipment has been mishandled or abused.

FILL OUT OPPOSITE SIDE OF THIS FORM AND RETURN WITH EQUIPMENT.

INSTRUCTIONS FOR REPAIR ORDER – DRANETZ ENGINEERING LABS.

SECTION V

PARTS LIST

5-1. SCOPE

This section lists the parts required to support the Disturbance Simulator. Sufficient information is included to permit maintenance personnel to identify each maintenance part by part number, description, and supply source. Table 5-1 lists and identifies the manufacturers referenced in the parts list.

Table 5-1. List of Manufacturers

NOTE: When no manufacturer is specified in the parts list, the referenced part number is on the MIL Spec List. MIL spec parts are manufactured to meet Military Specifications and are readily available from a variety of suppliers.

1. Alco Electronic Products, Inc., 1551 Osgood Street, North Andover, Massachusetts 01845
2. Bourns, Inc., Trimpot Products Division, 1200 Columbia Avenue, Riverside, California 92507
3. Bussmann Manufacturing Division, McGraw Edison Company, 2536 West University Street, St. Louis, Missouri 63107
4. C & K Components, Inc., 103 Morse Street, Watertown, Massachusetts 02172
5. Cambion, Cambridge, Massachusetts
6. Cinch-Jones Connector Division of TRW, 1500 Morse Avenue, Elk Grove Village, Illinois 60007
7. Clarostat Manufacturing Company, Inc., Washington Street, Dover, New Hampshire 03820
8. Cornell-Dubilier Electric, 150 Avenue L., Newark, New Jersey 07101
9. Cutler Hammer, 4201 North 27th Street, Milwaukee, Wisconsin 53216
10. Dranetz Engineering Labs Inc., 1000 New Durham Road, Edison, N.J. 08818
11. Electrocube, Inc., 1710 S. Del Mar Avenue, San Gabriel, California 91776.
12. Elmenco-Arco Electronics, Community Drive, Great Neck, New York 11022

13. F-Dyne Electronics Co., 449 Howard Avenue, Bridgeport, Connecticut 06605
14. Signal Transformer Company, 1 Junius Street, Brooklyn, New York 11212
15. Sprague Electric Company, 645 Marshall Street, North Adams, Massachusetts 01247
16. Struthers-Dunn, Inc., Lambs Road, Pitman, New Jersey 08071

REPLACEABLE PARTS LIST
MODEL 604A DISTURBANCE SIMULATOR

Reference Designation	Manufacturer	Part Number	Description
	DEL	103076	Cable Assembly
P1	Cinch-Jones	P-308-CCT-L	Plug (8 pins)
J1	Cinch-Jones	S-308-AB	Receptacle (8 socket)
R1	Clarostat	RV4SAYSD104A	Var. Res. 100K
R2,R3	Clarostat	RV4SAYSD102A	Var. Res. 1K
R4	Clarostat	RV4SAYSD502A	Var. Res. 5K
S1,S2,S3	Cutler-Hammer	SAZZGDX13-3	Switch, Pushbutton (DPDT)
S4,S5	C & K	7201	Switch, Toggle (DPDT)
S6	Alco	MSS-4300	Switch, Slide (4P3T)
S7	Switchcraft	46206LFR	Switch, Slide (115/230)
F101	Bussman	MDL-100	Fuse, 1/10 Amp. Slow Blow
R101		RN60C1742F	Res. 17.4K ± 1%, 1/8W
R102,R104		RN60C2431F	Res. 243K ± 1%, 1/8W
R103		RN60C3321F	Res. 3.32K ± 1%, 1/8W
R105,R106,R118, R115		RCR07G102J	Res. 1K ± 5%, 1/4W
R107,R108		RCR07G431J	Res. 430Ω ± 5%, 1/4W
R109		RCR07G332J	Res. 3.3K ± 5%, 1/4W

REPLACEABLE PARTS LIST (Cont'd.)

Reference Designation	Manufacturer	Part Number	Description
R110	Bourns	3386W-1-104	Var. Res. 100K
R111		RCR07G56ZJ	Res. 5.6K ± 5%, 1/4W
R113		RCR07G241J	Res. 240Ω ± 5%, 1/4W
R114		RCR07G43ZJ	Res. 4.3K ± 5%, 1/4W
R116		RCR07G112J	Res. 1.1K ± 5%, 1/4W
R117		RCR07G123J	Res. 12K ± 5%, 1/4W
R120, R121		RCR07G471J	Res. 470Ω ± 5%, 1/4W
R122	Bourns	3386W-1-203	Var. Res. 20K
C101, C102, C103		CS13F476K	Capacitor 47μf ± 10%, 35V
C104, C106		CK63AW103M	Capacitor, .01μf ± 20%, 500V
C105	Sprague	192P10392	Cap. .01μf ± 10%, 200V
C107	Electrocube or F-Dyne	625D1B155K or MPC-12-1.5-100-10	Cap. 1.5μf ± 10%, 100V
C108	Elmenco	DM19-332J	Cap. 3300pf ± 5%, 500V
C109	Cornell Dubilier	WBR10-150	Cap. 10μf ± 10%, 150V
T101	DEL	103077	Transformer
T102	Signal	DPC-40-110	Transformer
CR101, CR102		1N4009	Diode
CR103, CR104, CR106, CR107		1N4005	Diode
CR105		1N968B	Zener Diode
CR108, CR109		1N978B	Zener Diode
Q101		2N4442	SCR
K101, K102	Struthers Dunn	MRRNIA-24V	Relay, 24 Volts

SECTION VI

DIAGRAMS

Figure

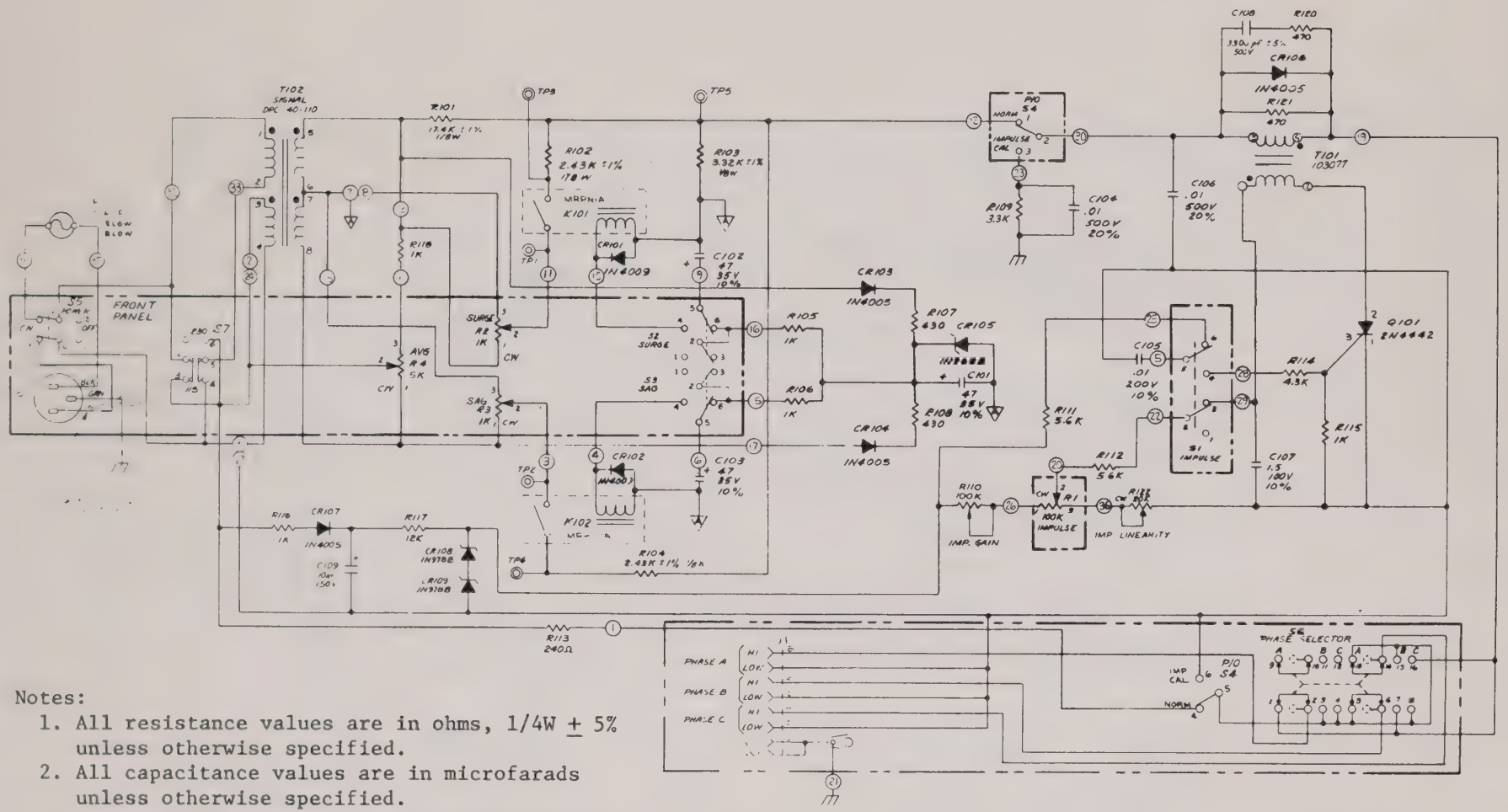
6-1 Model 604A Disturbance Simulator, Schematic Diagram . . . 6-2

6-2 Model 604A, Interconnection Diagram 6-3

6-3 Model 604A, Assembly Diagram 6-4

6-4 Model 604A, Parts Location 6-5

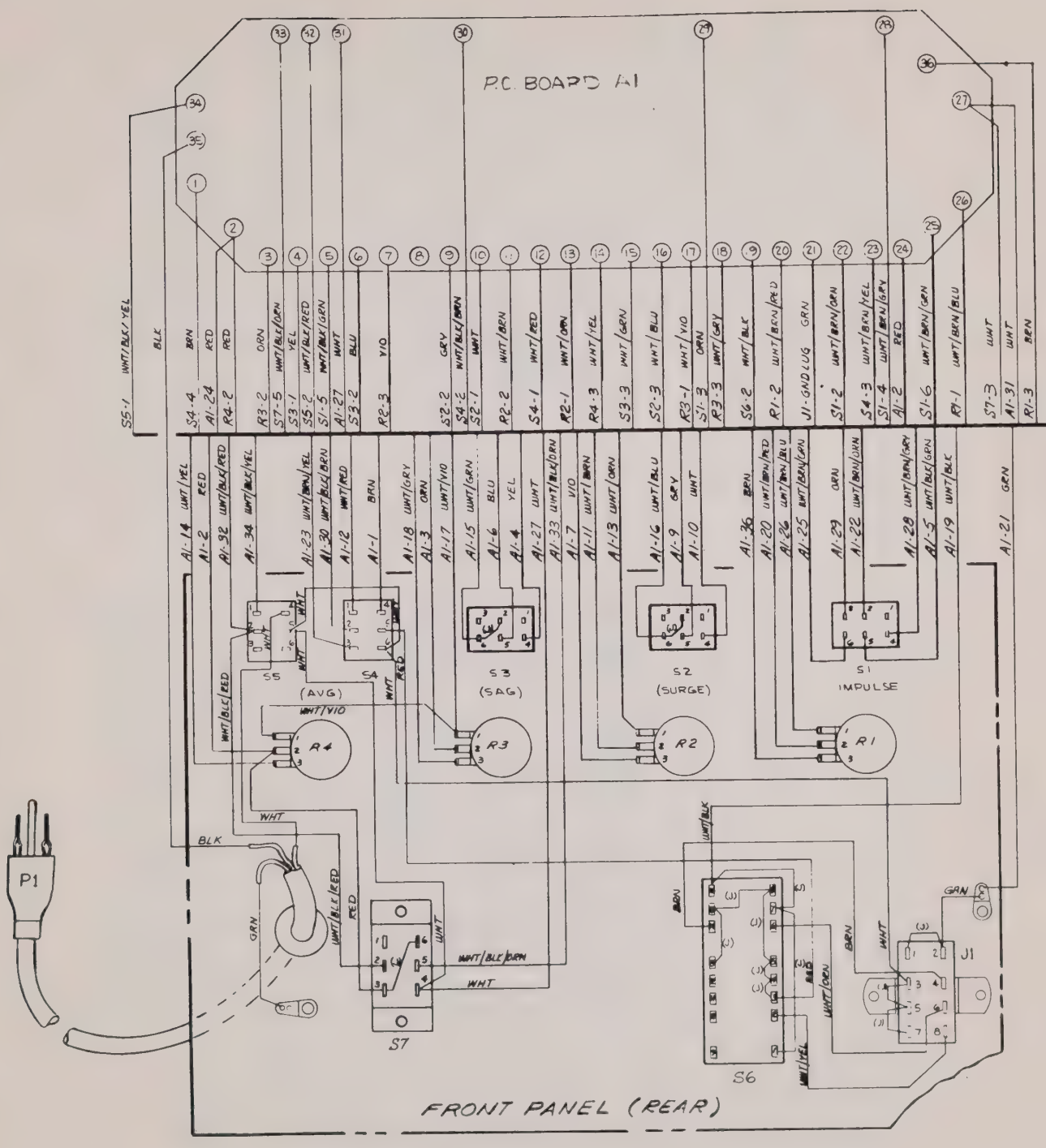
B — C106 was Switchcraft 49331LS, C108 was .0033 ± 10%, 500V.
R110 was 20K, R113 was 3.3K. Added R122, Removed R119.
Revised C105, S7, S2, and S3 wiring.
TP5 was TP3. Added TP3 and TP4.



Notes:

1. All resistance values are in ohms, 1/4W ± 5% unless otherwise specified.
2. All capacitance values are in microfarads unless otherwise specified.
3. Components located within dark phantom lines appear on front panel.

Figure 6-1. Model 604A Disturbance Simulator, Schematic Diagram



NOTE: All wires to be 24 AWG unless otherwise specified.

REVISION	INFORMATION
B	Revised S2, S3, S6, S7, and R1 wiring. Added A1-36. Added wire colors.

Figure 6-2. Model 604A Disturbance Simulator, Interconnection Diagram

REVISION INFORMATION

B Heyco bushing SR6P3-4 was Heyco 5P4 or H.H. Smith 939. S6 was Switchcraft 49331LS. Repositioned front panel ground lug away from corner. Specified small pattern flat washer on printed circuit board mating screws. Changed bottom 4 slots on J1 from Vertical to Horizontal.

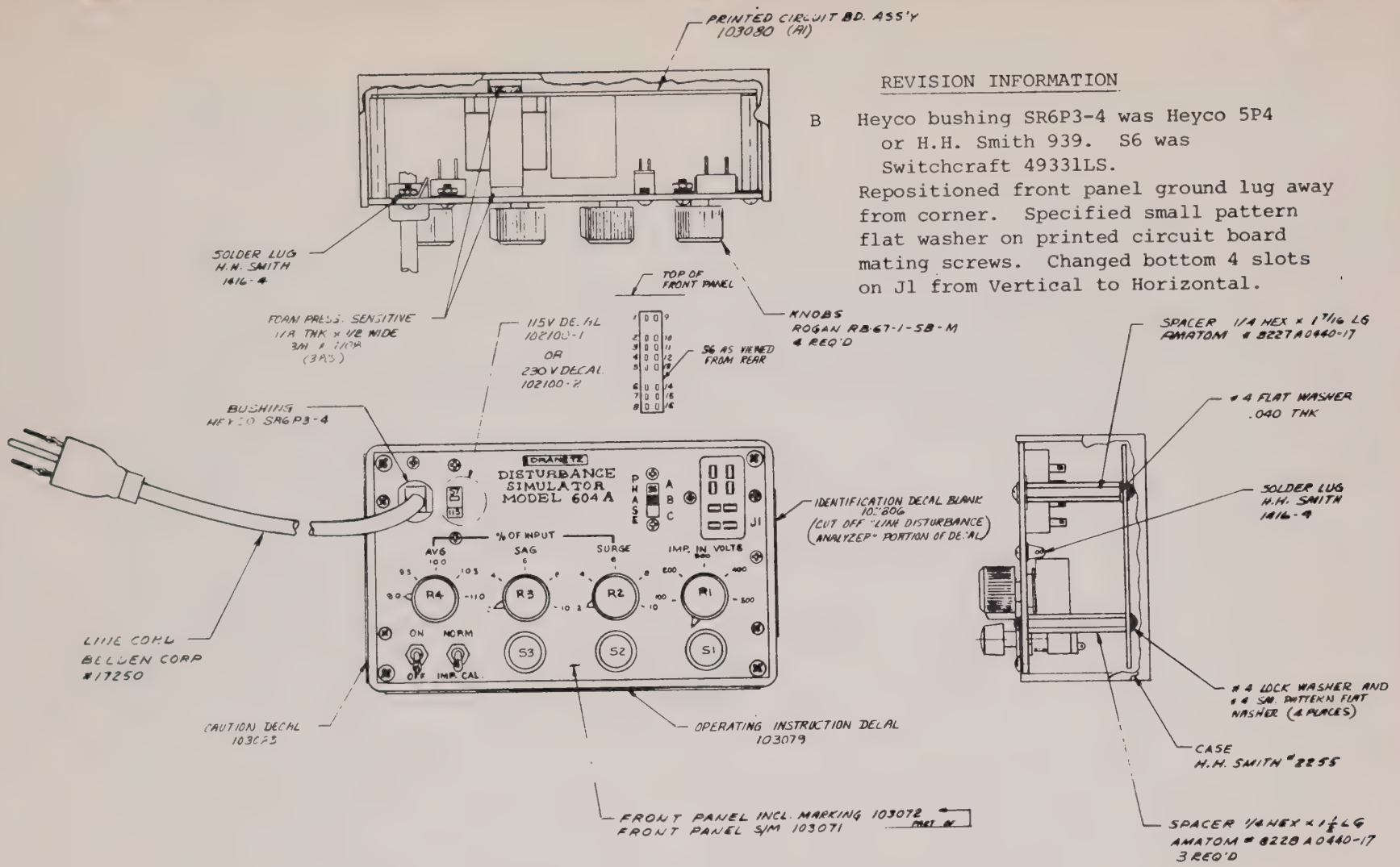
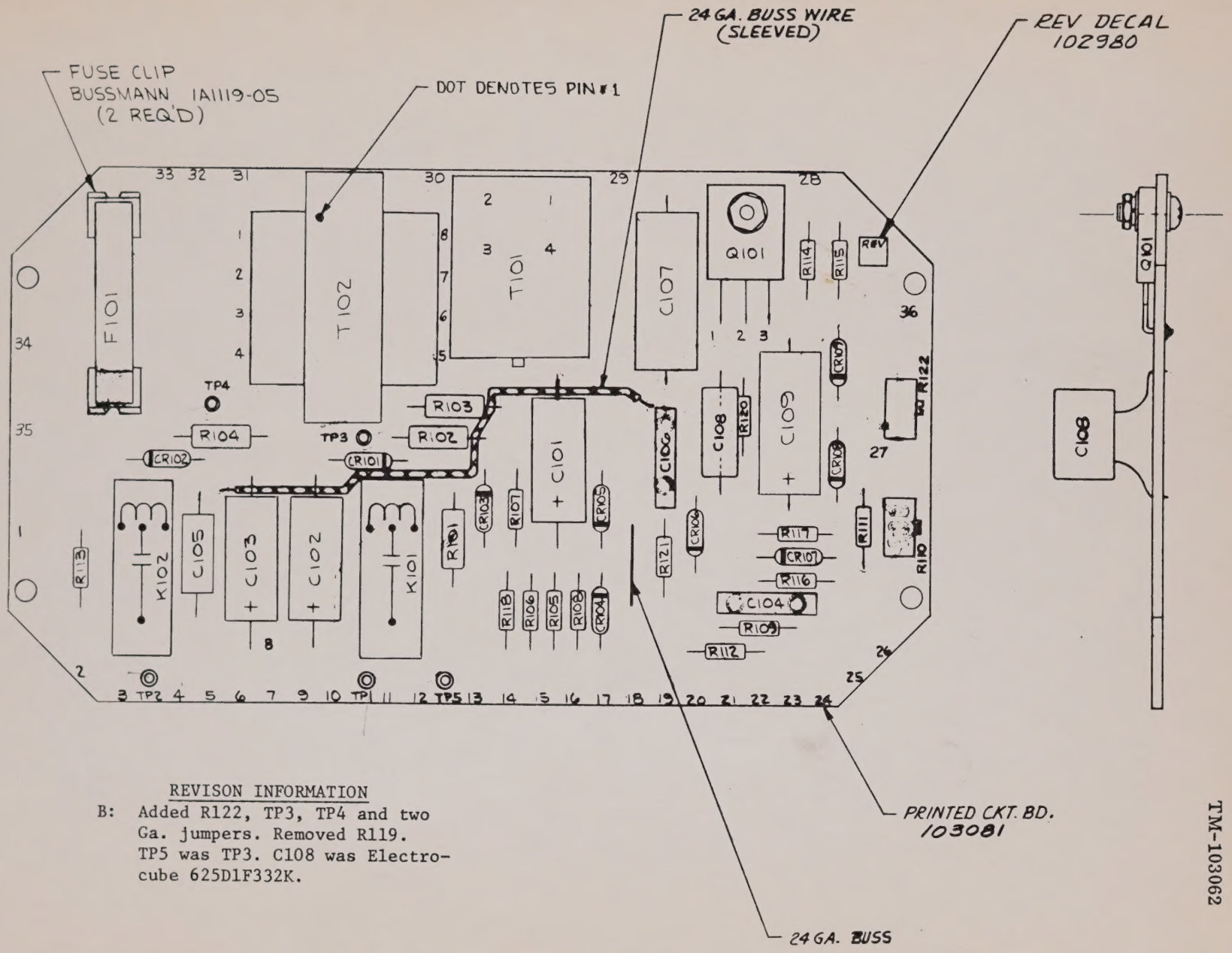

PRINTED CIRCUIT BD. ASS'Y 103080 (A1)
SOLDER LUG H.H. SMITH 1416-4
FOAM PRESS. SENSITIVE 1/4 THK x 1/2 WIDE
TOP OF FRONT PANEL
KNOBS ROGAN RB-67-1-SB-M 4 REQ'D
115V DECAL 102100-1
OR
230 V DECAL 102100-2
S6 AS VIEWED FROM REAR
SPACER 1/4 HEX x 1 7/16 LG AMATOM # 8227A0440-17
4 FLAT WASHER .040 THK
BUSHING HEYCO SR6P3-4
DISTURBANCE SIMULATOR MODEL 604A
PHASE A B C
% OF INPUT
AVG SAG SURGE IMP. IN VOLTS
R4 R3 R2 R1
ON NORM
OFF IMP. CAL.
S3 S2 S1
J1
IDENTIFICATION DECAL BLANK 103806 (CUT OFF "LINE DISTURBANCE ANALYZER" PORTION OF DECAL)
SOLDER LUG H.H. SMITH 1416-4
LINE CORD BELDEN CORP #17250
CAUTION DECAL 103023
OPERATING INSTRUCTION DECAL 103079
4 LOCK WASHER AND # 4 SM. PATTERN FLAT WASHER (4 PLACES)
CASE H.H. SMITH #2255
FRONT PANEL INCL. MARKING 103072
FRONT PANEL S/M 103071
SPACER 1/4 HEX x 1 1/2 LG AMATOM # 8228A0440-17 3 REQ'D

Figure 6-3. Model 604A Disturbance Simulator, Assembly Diagram



REVISON INFORMATION

B: Added R122, TP3, TP4 and two Ga. jumpers. Removed R119. TP5 was TP3. C108 was Electro-cube 625D1F332K.

Figure 6-4. Model 604A Disturbance Simulator Parts Location

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